


Advanced Li-Ion Polymer Battery Cell Manufacturing Plant in USA

Lee

LG Chem Michigan Inc.

May 13, 2013

Project ID : ARRAVT001

OVERVIEW

TIMELINE

- Start date : 09/01/2009
- End date: 05/31/2013
- Percent Complete: 84%

BARRIERS

- Investment Cost Increase
- Adaptation and application of new technology into new facility
- Low market demand

BUDGET

- Total Project Funding:
  -DOE Share: $151,387,000
  -LGCMI Share: $155,140,000
- Funding Received by 2013.1Q
  : 140.8M
- Funding for FY2013 Project
  : None

PARTNERS

- DOE/NETL
- LG Chem Ltd.
- Architect & Engineering Firm
- Design Builder
- State of Michigan
- City of Holland, MI
- Various suppliers near Holland

PROJECT OBJECTIVE
: LI-ION BATTERY CELL MANUFACTURING FACILITY

To design, construct, start-up and test a production facility for Li-Ion Polymer Batteries in Holland, Michigan, USA.

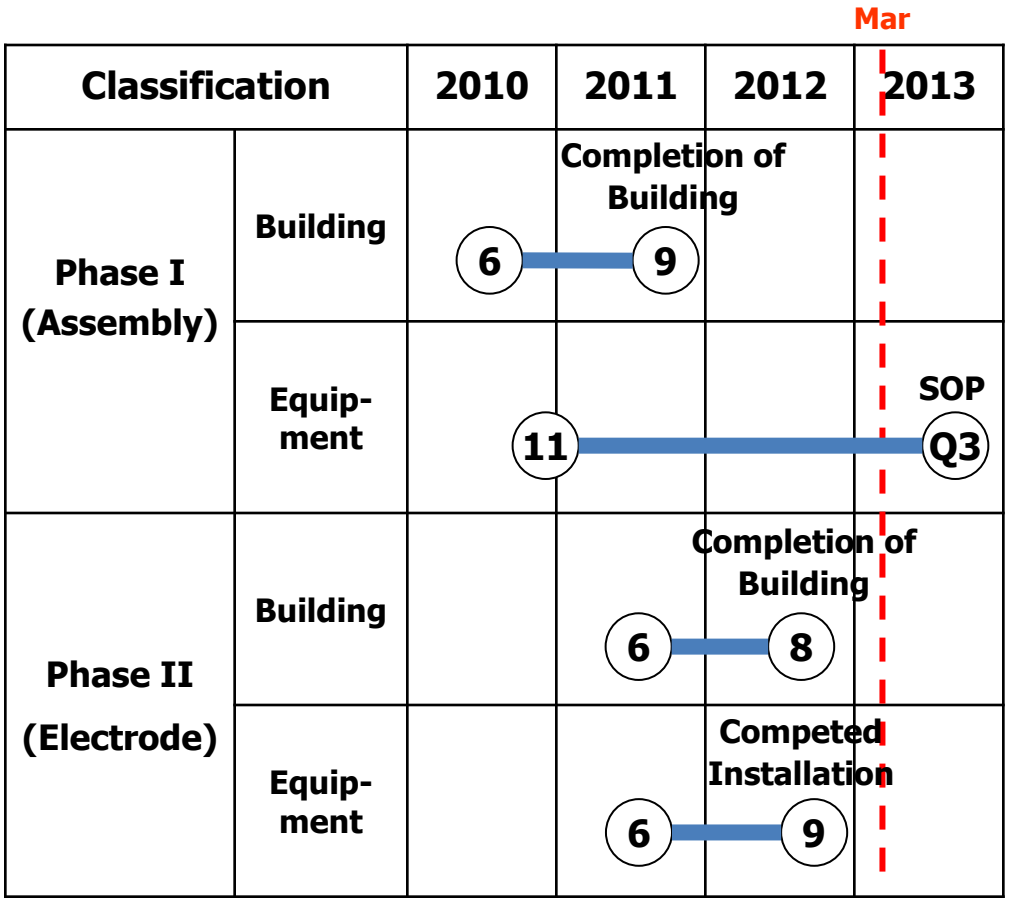
- Due to low market demand, the start of production has been postponed to 2013.
- After starting assembly operations in 2013, the various efforts will be continued to stabilize production and to provide quality products to customers.
- When it reaches full-scale operation in 2016, more than 400 direct employees (Operators, Engineers, Management & Administration staff) will be working at the facility.

Number of Employee by Year

MILESTONES I.

Postponed Start of Production due to low market demand.

Schedule



Updates

- **Phase I : completed**
  - Completed all construction works in 2011
  - Completed production equipment installation and verification
- **Phase II (Electrode Line) : completed**
  - Completed all construction works in 2012
  - Completed equipment installation

MILESTONE II.

2010

08/2009 DOE Grant Award

05/2010 Completion of General Contractor Selection

07/2010 Groundbreaking Ceremony

2011

02/2011 Completion of Enclosure

09/2011 Completion of Equipment Set-up (Assembly)

10/2011 Started Production Process Verification

2012

01/2012 Achieved the ISO/TS 16949 LOC

09/2012 Completion of Equipment Set-up (Electrode)

2013

04/2012 Under Product and Process Verification

MANUFACTURING FACILITY

With the cooperation of various USA partners, the building and its utilities were successfully constructed and installed to support cell manufacturing technologies.

Regenerative Thermal Oxidizer

Bird Eye View of LGCMI

Dry and Clean Room

Road Expansion by City of Holland

Acetone Tank and Nitrogen Tank

VERIFIED EQUIPMENT

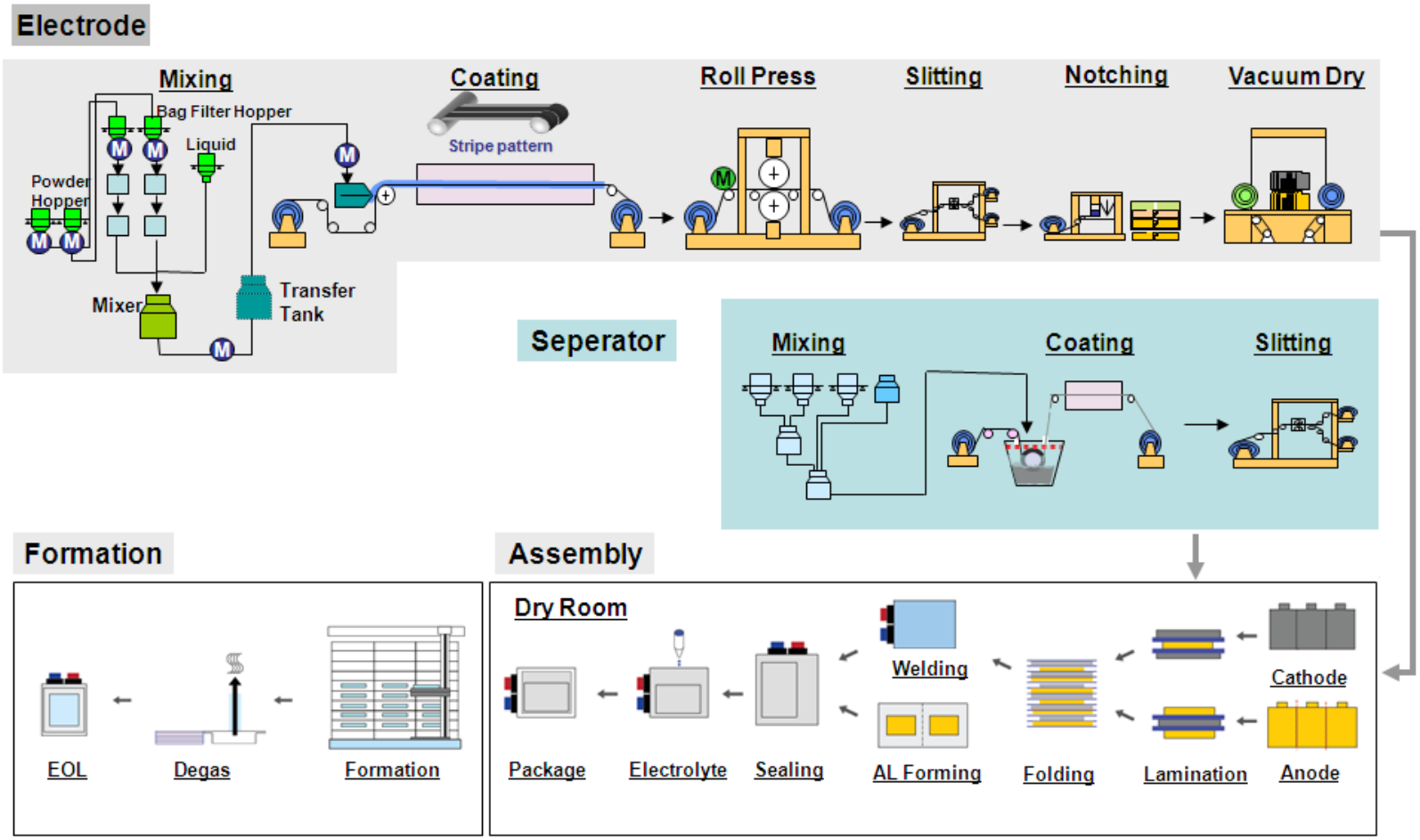
The verified quality equipment that has been used in Ochang, Korea was duplicated and set-up in Holland, MI, USA.

LG Chem (Ochang, Korea) = **LGCMI (Holland, MI, USA)**

SRS	Mixing Equipment Coating Equipment
Assembly	Notching Equipment Lamination Equipment Folding Equipment Packaging Equipment
Formation	Charging/Discharging Equipment Aging Equipment
QA	Inspection Equipment Test Equipment
Electrode	Mixing Equipment Coating Equipment

REPLICATION OF PRODUCTION PROCESS

Adopted and replicated the most cutting edge Li-ion production manufacturing process into USA.



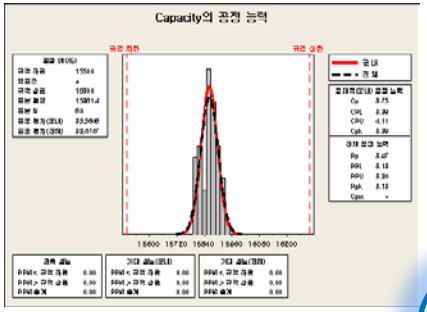
COMPLETED THE PROCESS VERIFICATION

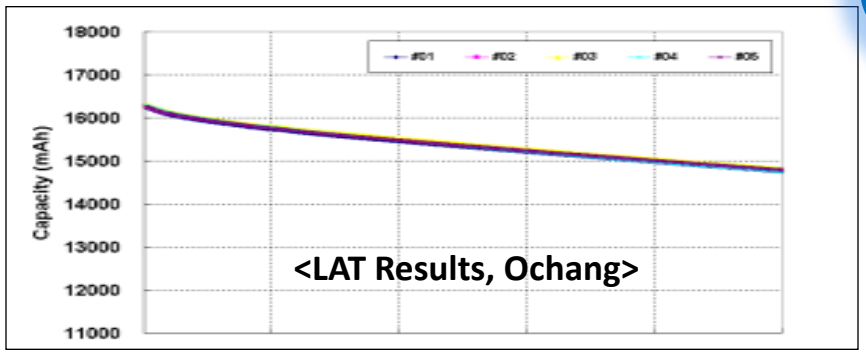
Completed the process and product verification tests.
: Verified more than 30 items including dimensions, performance, reliability and safety tests.

➡ Identically similar results between Korea and USA produced cells

Ochang Line 3

Capacity	
Average	15.86
Maximum	15.94
Minimum	15.79
N	60
CpK	3.39





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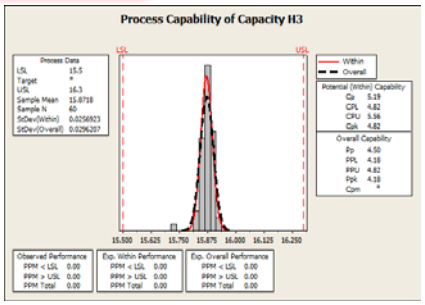
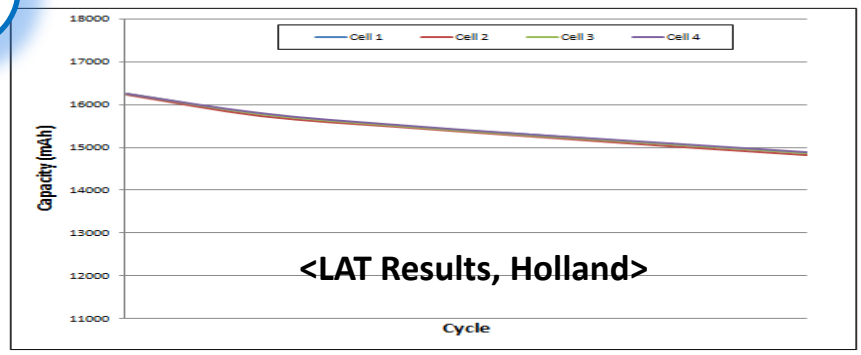
Holland Line 3

Capacity	
Average	15.87
Maximum	15.92
Minimum	15.73
N	60
CpK	4.82





COLLABORATIONS & PARTNERSHIPS

Thanks to the great collaboration and enormous support from various public and private sectors, LGCMI could achieve the current status.

- **DOE/NETL**
  - ❑ Clear guidelines for the DOE billing and reporting requirements
  - ❑ Quick responses to specific inquiries
- **State of Michigan**
  - ❑ Financial incentives (=tax credit) to LG Chem Michigan Inc.
  - ❑ Coordination with state agencies (e.g., environmental permits)
- **City of Holland**
  - ❑ Support and assistance in various areas (e.g., road expansion, site preparation)
  - ❑ Renaissance zone designation in coordination with the state of Michigan
- **Private Sector Partnership**
  - ❑ Timely co-operation and excellent support in the various stages of the project
  - ❑ Anchor company of Michigan's SmartCoast Advanced Energy Storage cluster

SUMMARY

LG Chem/LGCMI successfully completed project phase I (Assembly).

1) **Construction of building and facility was completed.**
   - **No major or safety issues.**

2) **Completed the installation of cell manufacturing equipment.**
   - **Verified equipment used in Ochang, Korea was installed and set-up.**

3) **Successfully replicated the cutting edge manufacturing technologies.**
   - **Same advanced technologies for Li-ion cell manufacturing process were introduced to USA.**

4) **Process and product verification are under testing.**
   - **Verification test results have been the same betwee Ochang, Korea and Holland, USA.**

5) **ISO/TS 16949 system was implemented.**
   - **Receive ISO/TS Letter of Conformance on Jan 31, 2012**

SUMMARY (CONT.)

6) **Hired and trained full time employees (151 as of 2012)**
- **Trained them with differentiated and systematic training program.**
- **➔ Intensive and repeated practice are being performed to achieve a similar skill level with Korea.**

Project phase II (Electrode) is successfully completed

1) **Construction of facility for electrode**
- **Completed**

2) **Delivery and installation of electrode manufacturing equipment**
- **Completed**

FUTURE WORKS

To successfully complete the project, LGCMI's future work shall include:

1) **Customer Approval for Production Line**

- Will receive official customer approval for the production line for mass production.
- PPAP and QSB : On-going

2) **Start of mass production and quick stabilization of production**

- Enhance employee skill levels.
- Continue to produce best quality products for our customers

OF THE US PEOPLE, BY THE US PEOPLE, FOR THE US CUSTOMERS

We, as LGCMI, produce the Li-ion cells that will power the electric vehicles of the United States of America